
Growth and Development in Brazil: Cardoso's *Real* Challenge

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CHAPTER 6

Knowledge as a Constraint on Growth

Simon Schwartzman

One of the few consensuses in the literature of economic development is about the critical role of knowledge. A recent UNESCO/CEPAL document phrased the question in the following terms:

En los países desarrollados y en las experiencias exitosas de la llamada 'industrialización tardía' en otras latitudes, existe un claro reconocimiento del carácter central que tienen la educación y la producción del conocimiento en el proceso de desarrollo, y en los países de la región esta actitud se ha extendido progresivamente. La difusión de valores, la dimensión ética y los comportamientos propios de la moderna ciudadanía, así como la generación de capacidades y destrezas indispensables para la competitividad internacional (crecientemente basada en el progreso técnico) reciben un aporte decisivo de la educación y de la producción del conocimiento en una sociedad. La reforma del sistema de producción y difusión del conocimiento es, entonces, un instrumento crucial para enfrentar tanto el desafío en el plano interno, que es la ciudadanía, como el desafío en el plano externo, que es la competitividad. Se entiende así que esta dimensión sea central para la propuesta de CEPAL sobre transformación productiva con equidad.¹

In Brazil, the lack of sufficient and adequate knowledge, in terms of general education, professional training and scientific and technological capabilities, has long been recognised as a major stumbling block for the country's development. Several policies have been tried to deal with these questions, some of them with important consequences, but they have all ultimately failed their broader purposes. This chapter will discuss some of these policies of the past (in basic, secondary and higher education, and in science and technology) present some ideas about why they did not succeed, and suggest some alternatives.

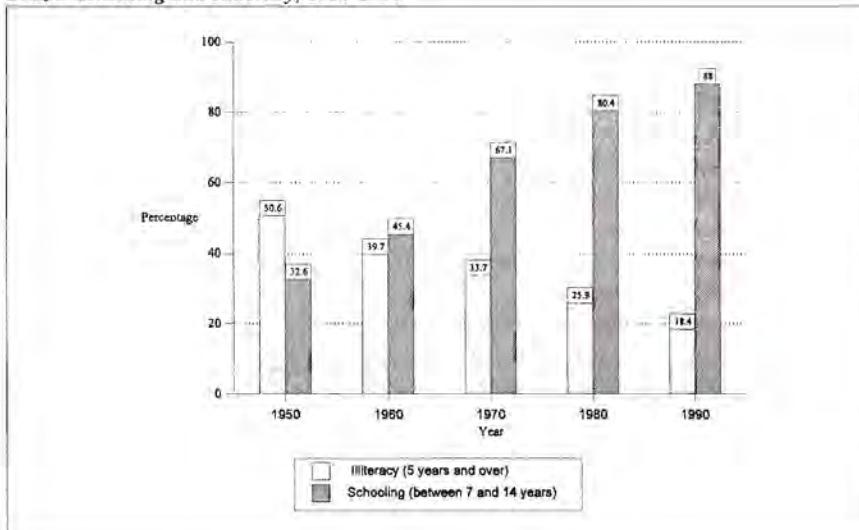
Basic Education: The Facts

The bare facts of Brazilian basic education are well-known.² In 1990, 18.4 per cent of Brazilians with five years or more schooling did not know how to read and write, according to a minimal definition of literacy. Data from the national household survey (PNAD) show that, in 1988, 35 per cent of the population between fifteen and thirty-nine years had completed eight years of schooling, another 10 per cent was expected to complete it after age fifteen, and 55 per cent would never complete it. This was an improvement compared to 1982, when the figures were 28 per cent, 7 per cent and 55 per cent, respectively. A comparison among generations shows a favourable development: the percentage of illiterates fell from 44 per cent to 14 per cent among those sixty and older and for those between ten and fourteen a reduction of 30 per cent was achieved. The evolution of literacy and schooling appears in Figure 1. Another characteristic is that, contrary to what happens in most other less developed countries, the education levels of men and women in Brazil are very similar. There are large differences,

however, in regional terms. In the Northeast, illiteracy reaches 33 per cent of the young population, and the intergenerational improvement falls from the global figure of 30 to a mere 23 per cent.

The usual conclusions from these and similar figures are that there are not enough schools, and that children abandon them at an early age. The traditional remedies are to build more schools, and to provide the children with incentives (such as school lunch) to stay there. Such policies, however, deal with problems that are now secondary. There is a lack of schools in some rural and poorer regions, but problems of overcapacity also exist in the large urban centres, such as São Paulo. The problems of street children in urban centres are all too visible, but it is unlikely that they derive from the lack of schools or of school lunch. Brazilians remain in school about 8.5 years, but do not reach on average more than the sixth year of schooling. About 50 per cent of the students fail and repeat the first year, and progress slowly until they reach fourteen or fifteen years of age, when they usually drop out. Contrary to common belief, the problem of school evasion in the first year of schooling is small, not more than 2.3 per cent, growing however to 32 per cent at the end of the fourth year.³

Figure 1
Brazil: Schooling and Illiteracy, 1950-1990



Source: José Goldemberg, *Relatório sobre a Educação no Brasil*, São Paulo, Instituto de Estudos Avançados, Coleção Documentos, 1993.

The main problem of basic education in Brazil today is not quantity, but quality and inequity, and they are associated. High rates of repetition are just the symptoms of a much deeper problem. No standardised tests are applied to

Brazilian students to assess what they learn at school, but the little evidence available shows very poor levels in the acquisition of basic reading, writing and arithmetic skills, even among students of private, middle-class schools. The problems of equity appear not only in the regional and urban-rural differences in school access and literacy, but also in the systematic association between social class and educational failure.

The volume of resources spent on education is inadequate, and could not be increased very much in the short-run, given the country's economic conditions. The Brazilian Constitution requires 18 per cent of federal taxes, and 25 per cent of state and local taxes, to be spent on education. The global figure for 1990 was twenty billion dollars, corresponding to 4.2 per cent of GDP, and 17.7 per cent of all public expenditures (Table 1). State and municipal governments are responsible for basic and secondary education, and contributed with 45 and 28.5 per cent of the total, respectively. Seventy-eight per cent of the students in primary education are in public schools, and the private sector does not receive public money. Average expenditures for students in basic municipal public schools went from US \$34.30 a year in the rural Northeast to US \$228.50 in the urban Southeast. These figures refer only to direct costs, including teachers' salaries, and exclude indirect costs such as the maintenance of the Secretaries of Education. In São Paulo, the richest state, this cost is about 7 per cent of the total, but in Piauí, at the other extreme, it reaches 59 per cent.⁴

Table 1
Brazil, Expenditure on Education, 1990

	<i>billions of US \$</i>	<i>Percentage</i>
<i>Federal Government</i>	5.2	26.1
<i>States</i>	9.0	45.2
<i>Municipalities</i>	5.7	28.6
<i>Total</i>	19.9	100.0

Source: José Goldemberg, *Relatório sobre a Educação no Brasil*, São Paulo, Instituto de Estudos Avançados, Coleção Documentos, 1993, p. 15. Data from Ministério de Educação e Cultura.

Basic Education: Policies

The first attempts to organise public elementary education in some Brazilian states occurred only in the 1920s and 1930s; before that, basic education was only provided to the children of the elites by the Catholic Church, or organised by immigrant communities, often with the Church's support. The educators in the 1930s and 1940s believed in the redeeming role of education as the solution of Brazil's social, economic and moral problems, but their success in mobilising the governments in educational projects was limited.⁵ In the sixties, the notion that education was a mechanism for the social reproduction of inequality was very popular among Brazilian educators. The implication was either that

education should be used as an instrument for social revolution, as put forward by Paulo Freire, or that education would be irrelevant as long as the country's social and economic conditions did not change.

In official circles, the usual recipe for the problems of basic education in Brazil was always some combination of more schools, more salaries for teachers, teacher training, and social assistance to the students. The high rates of illiteracy led to sporadic campaigns for adult education. Of those, school building and social assistance for the students have been more prominent in recent years. They are the landmarks of the programme of the state government in Rio de Janeiro, which consists in the building of several hundred places where students could spend eight hours a day and benefit from a wide range of social services, from lunch in the morning to a shower in late afternoon, and classes in between. Each institution is known as a Centro Integrado de Ensino Popular (CIEP).

The federal government tried to follow a similar path. Because basic and secondary education are responsibilities of state and local authorities, most of the regular education resources of the Federal government in Brazil go to higher education. There is, however, a large discretionary fund created by the *salário educação*, a 2.5 per cent tax on all salaries, which goes to a National Education Fund (Fundo Nacional de Educação, FNDE). The current estimate is that this fund generates about 1.5 billion dollars a year; two-thirds remain in the states where the resources are generated, and one third, or 500 million dollars, goes to the Ministry of Education for redistribution.⁶ This fund is supposed to be used for school construction and reform, acquisition of equipment, teacher training and other special projects. It should also compensate for regional imbalances, and in fact, in poorer states, the resources received from the federal government's third are usually more than what they can get directly from their share. But they have also been the main source of political patronage within the Ministry of Education, leading to irrational allocations and corruption.

Besides the distribution of these resources, the Ministry of Education handles two large distributive programmes, one of school lunch and another of school books. Both programmes have been plagued by the physical, administrative and probity problems of buying and distributing millions of lunches and books throughout a territory of more than eight million square kilometres. Inspired by the example of Rio de Janeiro, the Collor government launched an ambitious programme to build several thousand 'integrated schools' (Centros Integrados de Atendimento à Criança, CIACS) throughout the country, which would be handed to local governments and institutions for administration. This programme was scaled down, but retained by the Itamar Franco administration, in spite of its enormous potential for graft and patronage, and doubtful pedagogical justification. In theory, the federal government retains the ability to establish the content and minimum requirements for all levels of education, through a Federal Council of Education (CFE) formed by personalities

appointed by the President of the Republic for long mandates. Instead of a policy agency, however, CFE behaves mostly as a notarial agency handling matters like the authorisation for the establishment of private higher education institutions.

The construction of highly visible school buildings filled with happy, clean and educated children sounded wonderful pedagogically, excellent in an election campaign, and very convenient for the construction companies. The most obvious difficulty was money. In spite of the high priority given to the programme in Rio de Janeiro, the number of buildings constructed was far from what was announced at the beginning, and very few of them worked according to plan. More seriously, it sidestepped completely the regular school system in the state.⁷

A new consensus has been developed among Brazilian educators in recent years.⁸ Basic education is now seen with less optimism than in the 1930s, but with less pessimism than in the years of the 'reproduction' theory. Education by itself will not solve the country's problems of economic underdevelopment and social inequality, but could give an important contribution to these goals through better use of the existing resources, and the mobilisation of additional resources from the community. Good teaching matters, and depends more on the teachers' competence and involvement and the teaching environment than on specific pedagogic orientations. Resources, better salaries and teacher education are obviously necessary, but there is a growing realisation of the importance of deep institutional reforms. In the present situation, public schools are run by directors nominated by the state or municipal authorities, and have little or no autonomy to handle the school budget, decide about who will be teaching, and the content of education. Teachers are usually unionised, and deal directly with the Secretaries of Education in their negotiations (and often prolonged strikes) for better salaries, fringe benefits and working conditions. They are extremely critical of the educational authorities, and cynical about new proposals for educational reform coming from them. Parents have little say in school activities, because most decisions are taken elsewhere anyway; they are happy enough if the schools are open and their children receive some instruction and, eventually, a lunch.

This situation could start to improve if, first, authority and initiative were returned to the school level, and more precisely to the school's director; if the community could become more involved with the schools' activity, including the nomination and supervision of the director's activities; and if regular and systematic information on education results were gathered systematically and handed over to the educational authorities, schools and the students' families. In other words, the schools should become more involved, more responsive, more able to tap the resources (including financial resources) from the local communities, and more stimulated to do so. The federal government should restrict itself to set educational standards and to redistribute resources according

to strict criteria of income redistribution and support for worthy projects. Another consensus is that the teacher presence and motivation, and the learning environment provided by the school, is more important than one or another pedagogical orientation or changes in curriculum content. Learning should take precedence over social care, and also over the sheer construction of school buildings. A more decentralised and motivated school system could reduce dramatically its overhead costs, pay more to the teachers who are actually involved in class work, and provide them with programmes of further education.

Some Brazilian states are starting to reform their educational systems along these lines, and are receiving support from the World Bank and other international agencies (the state of Minas Gerais is probably the best known example). Resistance, however, is strong. Neither the Ministry of Education nor most state and local Secretaries of Education will give up willingly their authority to manage resources, nominate educational authorities, and carry on expensive social assistance and building projects, with all their political dividends. Systematic evaluation and the adoption of national standards of achievement will be resisted by the teachers, because it will amount to a quality control of their activities; and they will also resist the gradual loss of payment and working rules which would take place if decentralisation at the school level were fully implemented.

Reforms along these lines can lead to a serious problem of growing inequality, in a context which is already very unbalanced. State and federal governments can compensate for income differences, but not for the differences in local involvement, participation and demand for quality that will exist between social classes and regions where the schools are found. These differences, however, should be the consequence of some schools becoming better than others, which could help to locate the most troublesome spots and concentrate attention and resources on them.

The other difficult problem is that of the high retention rates in basic education, which is related to the whole question of curriculum content and student evaluation. Today, those who cannot pass the school tests at the end of one year are forced to repeat the grade in the following year. This is a doubtful pedagogic procedure that stigmatises the student, increases the cost of the whole system, and stimulates the student to drop out. The alternative, to move the students along the grades irrespective of what they learn, tends to be perceived as an unacceptable lowering of standards. The solution is likely to be in the direction of a complex system that could accept different learning rhythms for students with different learning abilities, which are usually related to their parents' social, economic and cultural backgrounds. More interesting classes, related to the present world, and given by motivated teachers, can also go a long way in motivating the students, and reduce their propensity to fail and eventually drop out of school.

Secondary and Vocational Education

Secondary education in Brazil was meant from the beginning, in the 1930s, to provide a narrow road to the universities and a broader road to vocational studies and professions. Originally, mandatory and free basic education was to last four years (the 7-10 cohort), and could be replaced by an entrance examination to the four years' gymnasium or to technical schools, the first tier of secondary education (the 11-15 cohort). Those graduating from the gymnasium could then enter the upper tier of secondary education (the 16-18 cohort), divided between a humanities (called 'classic') and a science option. Both led to the university, after an entrance examination for a faculty in a learned profession. An alternative was the courses for primary school teachers (*escolas normais*), which at the beginning did not lead to the universities.

Professional education for the 11-15 cohort, however, was never implemented on an extensive basis. The industry and business sectors established their own system of technical training, tuned to their needs and mostly restricted to the children of their employees (Serviço Nacional de Aprendizagem Industrial, SENAI and Serviço Nacional de Aprendizagem Comercial, SENAC).⁹ In the forties and fifties a large number of private 'schools of commerce' were created to provide cheap secondary education for those who neither qualified to enter the few public and highly selective secondary schools (like the Ginásio Pedro II, in Rio de Janeiro, or the Ginásio Mineiro, in Belo Horizonte) nor could pay the costs of private education in a Catholic school.

The main change occurred in the mid-sixties, when mandatory, basic and free education was extended from four to eight years. The public sector now had the obligation to provide free education for eight years, instead of four. The additional four years kept the curriculum and organisation of the old gymnasium, and the dividing line between the 1-4 and the 5-8 levels still appears in the statistics, which shows many students leaving school after the fourth level, and a high number unable to pass from the fifth to the higher levels of basic school. One consequence of this change was that the number of persons 'failing' to complete basic education increased dramatically; the other was that the attempts to diversify the curriculum at the 5-8 levels were in practice abandoned.

Secondary education has remained largely unchanged to the present day, in spite of a legislation that, between 1971 and 1982, required all secondary schools to provide some kind of professional skill to their students. This requirement did not find support among schools and students, led to ritualistic and bureaucratic responses, and was finally abandoned. The main obstacle for the development of professional secondary education is the selectiveness of Brazil's education system. Those who enter the old gymnasium, and the current secondary schools, are either from the upper and middle classes, or aspiring to

join them. A university degree is still an important credential to enter the middle-class job market in the urban centres and the public sector, and the wage differentials associated with education are still too high to justify an option for a non-university profession (Table 2).

Table 2
Income Differentials According to Years of Schooling (percentages, selected groups)

years of schooling	Income Groups		
	less than one minimum wage (%)	3 to 5 minimum wages (%)	more than 10 minimum wages (%)
less than 1 years	45.48	6.29	0.49
3 to 4 years	26.21	15.99	3.19
5 to 8 years	21.01	18.34	4.50
9 to 11 years	10.75	23.11	13.15
more than 12 years	1.87	14.90	44.84

Note: The figures in this table are for selected groups and do not total 100.

Source: calculated from Fundação IBGE, *Anuário Estatístico do Brasil*, 1992, p. 291.

The high visibility and urgency of the problems of basic and higher education, with their striking teachers and recurrent budgetary crises, left secondary education in a vacuum. Seventy per cent of the secondary school students are in public institutions, but the old prestigious secondary and teaching public schools have lost their lustre: they expanded enormously, receiving less qualified students from lower social strata, and the old generation of renowned teachers was not replaced by the brightest, who now prefer university careers.

Little is known about what students actually learn at secondary schools, except in terms of their approval rates in the universities' entrance examinations. Two generalisations are possible: private secondary schools are much better today than the public ones in preparing students for the universities; and the students' average qualifications are extremely low, forcing the universities to lower their entrance requirements in the less prestigious careers to fill their vacancies.¹⁰ Since secondary education is in practice a preparatory course for the universities, there have been attempts to influence its content through changes in the university entrance exams (for instance, moving from multiple choice to written tests to stimulate the development of writing skills).

The federal government has a small network of technical, secondary schools, with about 100,000 students, and there are also thirteen technical schools supported by São Paulo state. Teaching at the technical federal schools is usually better than in other public secondary schools, and its students tend to aspire to university careers. On the other hand, the SENAI-SENAC system embraces about 2.5 million students each year.

The current thinking about secondary education is that general skills, in language and mathematics, and general information about society and the contemporary world, are more important than narrow technical training, in terms of the demands of a changing labour market characterised by an expanding service sector and a shrinking industrial basis. If this is correct, then schools and students are right in rejecting mandatory professional education. There is ample room for improvement in secondary education, however, away from rote learning and in the direction of closer links between the classroom and the real world, including the transmission of different kinds of practical skills and information. It also means that the professional courses provided by SENAI-SENAC should evolve from the transmission of narrow technical skills to the provision of broader competencies. The wall between academic education for the universities and technical education for the vocational professions should be broken down on both sides, but this depends very much on the forces that shape secondary education – the number and skills of students coming from basic education, the career perspectives provided by universities, and the interest and willingness of the business sector to become more involved with vocational training of a new kind.

Higher Education: The Facts

Only about 10% of the age cohort enters higher education in Brazil, a very low figure in comparison with other countries, even in Latin America. Enrolments have been stable since the early eighties, in spite of continuous population growth. The usual explanation is that there are not enough jobs for those who graduate. The reality is that there are jobs, but not necessarily in the fields defined by the graduate's diplomas, especially in the new and 'semi' professions, such as administration, psychology or the social sciences. Two other factors may explain better this stagnation; the supply of students coming from secondary schools is not growing; and the cost of private education, which, although not very high, is too much for persons coming from the lower social strata in this period of economic stagnation. The private sector is also suffering the slack that followed the rapid expansion of the seventies, when economic growth and rising expectations led to unrestrained growth of low quality institutions.

A striking feature of Brazilian higher education is the contrast between its ideology and its reality. The ideology is expressed in the 1968 legislation, passed by the military regime, but strongly supported, until today, by the university professors' unions, students' associations and most academic authorities. It says that higher education in Brazil is organised in universities covering the main fields of knowledge, working simultaneously in research, teaching and extension work. Public universities are free and open to anyone who qualifies. All diplomas granted by universities are equally valid throughout the country, often assuring special privileges and professional monopolies. It is the task of the

Ministry of Education, and more specifically the Federal Council of Education, to make sure that quality is maintained and preserved throughout the system.

The practice is completely different. Brazilian higher education is extremely stratified, with a small number of good quality course programmes in a few universities, and a large basis of evening courses staffed by part-time lecturers awarding degrees of doubtful quality. One-third of the students are in public, two-thirds in private institutions. Most institutions do not have university status. The degrees they provide have the same legal value as the ones granted by the universities, but few grant the privileges of the traditional learned professions; business administration has the highest enrolments, followed by law, engineering and accounting. The full picture is given in Table 3.

Another way of looking at this system is in terms of its three main strata.¹¹ At the top, there is a small elite of about 14,000 faculty with doctoral degrees or equivalent titles and about 40,000 students in Master's and PhD programmes in the best public universities, mostly in the southern part of the country. Teachers receive reasonable salaries and can complement them with fellowships, research money and better working conditions (in spite of declining resources in the eighties); graduate students are selected among the best coming from public universities, do not pay tuition and receive a fellowship for two or more years.

Table 3
Brazilian Institutions of Higher Education (1990)

Type of institution	Institutions	Students	% of students
Federal Universities	37	305,350	19.5
State Universities	19	153,678	9.8
Municipal Universities	3	24,390	1.6
Private Universities	40	371,840	23.8
Municipal Federation of Schools	3	9,266	0.6
Private Federation of Schools	82	216,434	13.8
Isolated Schools (Federal)	19	14,785	0.9
Isolated Schools (State)	63	48,637	3.1
Isolated Schools (Municipal)	78	49,630	3.2
Isolated Schools (Private)	549	371,046	23.7
Total	893	1,565,056	100.0

The middle sector is made up of about 45,000 teachers in public universities, with relatively low academic status, and attending to about 450,000 undergraduate students. Many are active in their professions outside the universities, and teach only part-time. A large proportion of them, however, are part of the new breed of full-time teachers hired after 1968, very often on a provisional basis, with the expectation that they would eventually receive their academic degrees. They are mostly tenured, despite their scant academic achievements, and in most universities they can be promoted up to assistant professorship by seniority. Courses and facilities at this level are uneven, with

the best in the Centre-South and in the traditional professions, and the worst in public universities of the Northeast and in some of the newer fields. Students in public universities have access to almost free restaurants and a few other facilities, but it is very unusual for lodging to be provided and physical installations, laboratories, research materials and teaching aids are scarce. Students usually come from the best, private secondary schools, which means middle- to high-class families. As the educational system expanded, these students were faced with increasingly serious problems of unemployment, in spite of the relative quality of their education.

Finally, at the bottom, there are around 60,000 teachers serving about 600,000 students in private institutions. Most of these teachers are part-time, and earn most of their income from a professional career, or teaching in different institutions. Some have full-time appointments in public universities, and moonlight in private schools. They are not organised, and do not reproduce the teachers' associations that prevail in the public sector. Tuition in these institutions is low (seldom more than one hundred dollars a year) and government-controlled; however, the students can barely afford them. Facilities and teaching materials are minimal or nonexistent. Students tend to be poorer and older; courses are mostly in the 'soft' fields, and given in the evening. Most students are already employed in lower middle class or white collar jobs, and look for education for job improvement or promotion; they are usually more interested in credentials than in knowledge for its own sake.

These differences combine with profound regional imbalances and contrasts between the southern states, and more specifically the state of São Paulo, and the rest of the country. São Paulo is Brazil's biggest and most industrialised state, encompassing about one fifth of its population, and one third of its graduate enrollment. This is also the region where the dual nature of the Brazilian higher education system developed most fully. There is proportionally less enrollment in universities and public institutions than in other regions, but the universities (three of them supported by the state) are far better than in the rest of the country, while the private sector is much more complex and differentiated than elsewhere. There are few federal institutions in the state, which contrasts with the country's poorest region, the Northeast, where more than 70% of the students are enrolled in federal universities, with few alternatives in the private sector.

In spite of its relatively small size, public higher education in Brazil is unusually expensive, wasteful and very uneven in terms of quality. About 80 per cent of the federal education budget goes to the maintenance of its 37 universities and 19 independent schools, giving a gross cost of about US\$10,000 per student. About 90 per cent of these resources are used for salaries and retirement benefits, leaving very little for maintenance, equipment and investments. Academic men can retire with full salaries after thirty years of work, and women after twenty-five. Professors are civil servants, and cannot

be dismissed from their jobs except for felonies. Their teaching load is light,¹² their research output is limited; but salaries, including job security, early retirement, extended vacations and other benefits, are quite satisfactory in terms of what the private market can offer. There is no first hand information on the quality of the education provided, since proposals to establish systematic evaluation procedures have met strong resistance from the teachers' unions and academic administrators.¹³ Indirect information, on the academic qualification of professors, dropout rates, availability of libraries and other academic resources, and general reputation, suggest a very uneven picture, with some institutions and careers of very good quality, and a majority which would probably not pass more strict standards.

The second largest public system is the one provided by the state of São Paulo, which includes the Universidade de São Paulo (USP), Universidade de Campinas (UNICAMP) and the Universidade do Estado de São Paulo (UNESP). The *per capita* cost of this system is between half and two-thirds of the federal one, but the quality is better: most of the doctoral programmes in the country, and about half of the masters' programmes, are in these institutions, and the reputation of its professional courses is high.¹⁴ However, it is still a very expensive system. The state legislation grants a fixed fraction of the state's main tax to these three universities, which corresponds to about one billion dollars a year, distributed among the universities according to a fixed proportion. Only 12 per cent of the higher education students have access to these universities, while 80 per cent enroll in private institutions, the highest percentage in the country.

Issues and Policies in Higher Education

It is impossible to imagine that Brazilian higher education will evolve to meet the aspirations of the 1968 legislation. That model might have been appropriate for a small, elitist higher education system, or for a few institutions, but never for the system of mass higher education that gained strength in the following years. Two key features of the system, institutional differentiation and a large private sector, will remain. The real issues of Brazilian higher education are not the generalisation of the research university model or the end of the private system, but those of linking higher education to society's needs, increasing the efficiency of the public sector, reducing the social inequities built into the system, and preparing it for a new wave of expansion, which will take place when the economy starts to grow again.

Linking to society's needs: a question of quality

Manpower planning, the attempt to plan the quantity and contents of higher education to society's needs, is an idea of the past. It is impossible to know beforehand how much 'higher education' a society will need, or the percentage needed in each specialisation. The opposite idea, to make higher education fully

private and let it be ruled by market demands, does not make much sense either, and is not practised anywhere in the world: good quality higher education is more expensive than what individuals can normally pay, and the long-term benefits of large-scale, good quality higher education are unlikely to result from the aggregation of short-term, individual calculations.

Public higher education is therefore indispensable, and can go from fully public to mixed systems, and a variety of public support mechanisms for the private sector. The main question is how to introduce and guarantee quality in such systems. The first mechanism should be to reduce the value of educational credentials, and increase the value of effective skills. It requires the reduction or elimination of the corporatist legislation that creates professional privileges and sinecures. Some of this legislation affects the private sector, like the requirement that each pharmacy and drugstore should have a graduate pharmacist, or that only graduates in communication can work as journalists. Most of it, however, is sustained by the public sector, which recruits and grants promotions and salary increases according to the diplomas presented by candidates and employees. As skills replace credentials, one could expect the students to look for better institutions, and drive out of the education market those places that do not perform.

The second mechanism is the introduction of competitiveness for quality in the public sector, or among subsidised institutions. It requires the combined working of regular evaluation mechanisms, and decisional autonomy and flexibility at the institutional level. In Brazil, it will be necessary to take public universities away from the civil service, and turn them into independent and autonomous corporations, subject to public supervision and a competitive environment for resources.

The expected result of such institutional transformations is not a homogeneous, high quality system, but a highly differentiated one, with institutions working at the higher end, with research and graduate education, and others more oriented towards short-term, vocational education and other intermediate forms. The aim is to have quality at each level, instead of the formal but misleading equality of the current system.

Increasing efficiency

The main reason public higher education institutions are inefficient is that there are no incentives and benefits for more efficient management and administration. Most of the expenses, related to salaries, are decided by the government, and cannot be saved and used for other purposes. The São Paulo state system is more autonomous in this regard, since the universities work with global budgets that can be freely administered. Secondly, universities cannot negotiate salaries with individual professors and employees, and are not free to dismiss them if they do not perform, or if the demand for their speciality diminishes.

Table 4

Brazil: Expenditure on Science and Technology and Gross Domestic Product, 1980-1990, in US \$million (1991)¹

Year	I. Federal Budget ²	II. State Budget ²	III. Government Expenditure (I + II)	IV. Productive Sector Expenditure	V. National Expenditure (III + IV)	VI. National Expenditure as % of GDP
1980	824.5	496.8	1321.3	330.3	1651.6	0.43
1981	1519.6	672.4	2192.0	548.0	2740.0	0.74
1982	1863.3	654.6	2517.9	629.5	3147.4	0.85
1983	1475.4	462.6	1938.0	484.5	2422.5	0.67
1984	1426.9	500.7	1927.6	481.9	2409.5	0.64
1985	1953.9	501.9	2455.8	613.9	3069.7	0.75
1986	2288.6	651.3	2939.9	735.0	3674.9	0.84
1987	2556.1	466.9	3023.0	755.7	3778.7	0.83
1988	2506.4	396.7	2903.1	725.8	3628.9	0.80
1989	2147.1	512.5	2659.6	664.9	3324.5	0.71
1990	1679.0	672.2	2351.2	587.8	2938.9	0.72

Source: Sandra Brisolla, Indicadores Quantitativos de Ciéncia e Tecnologia no Brasil, paper prepared for the science and technology policy paper project, Fundação Getúlio Vargas, 1994.

Notes:

¹ Deflated according to general price index of the Fundação Getúlio Vargas (IGP-DI/FGV) and converted to US dollars according to the average rate for 1991

² Actual expenditures

Tuition in public universities is often proposed as a way of reducing costs and increasing efficiency. There are good arguments in its favour, especially if combined with fellowships and educational credit mechanisms. It would not be possible, however, to charge more than two thousand dollars a year to those who can pay, and this would cover only about 20 per cent of the current costs.

Reducing inequities and preparing for the future

At present, Brazil provides free higher education for the children of middle and upper classes that pass the entrance examinations of public institutions, and forces those less qualified, presumably with fewer resources, to attend the private, lower quality institutions. One way of solving this problem is by expanding the public system, and lowering its entrance requirements. The risk is a deterioration in the pockets of quality that still exist in the public system, without any assurance that they would be replaced by the private sector, or that the private sector would be less elitist. Another possibility is to charge for education in the public sector for those who can pay.

The most effective mechanism for increasing equality, however, would be to end the race for high-level credentials, and provide good educational opportunities at different stages and for different capabilities. Post-secondary, non-university education does not exist in Brazil. Attempts to create two- and three-year vocational courses have failed in the past, because of the opposition of the established professions and the public's aspirations for higher degrees. The situation now is probably different, and as the system expands, as it will in the future, short-term careers should come into intensive demand. The creation of passage mechanisms between short and long-term courses and careers could go a long way towards the elimination of the stigma usually associated with lower degrees.

Science and Technology

The recent history of the science and technology sector in Brazil is one of past enthusiasm and euphoria and present uncertainty and pessimism. Brazil started to invest heavily in science and technology in the seventies, building upon the small basis that survived the most repressive policies of the previous years. The landmarks of this period were the creation of the Financing Agency for Studies and Projects (FINEP), the transformation of the old National Research Council into an expanded Council for Scientific and Technological Development, the creation of the Universidade de Campinas and the graduate programmes of engineering at the Federal University in Rio de Janeiro (COPPE), and, more broadly, the establishment of several hundred reasonably well-supported graduate programmes in all areas of knowledge at Brazil's universities. These were the years of the nuclear agreement with West Germany, for the construction of an extensive network of atomic power plants and breeders, and of the policy of market reserve for microcomputer products.

By the 1980s this system had ceased to grow, and the resources available for research oscillated widely, as shown in Table 4. In the last decade, the national expenditures for science and technology have varied between two and four billion dollars a year, or 0.7 and 0.85 per cent of GDP, if we exclude the atypical figure of 1980.

It is difficult to say how much of this money goes to actual research, and how much is spent in administration, routine activities, acquisition of equipment for the military sector and other activities. In practice, Brazilian research and development institutions have faced enormous difficulties in recent years in obtaining support for their research, updating their libraries and laboratories and recruiting new talent. After the failure of the policies for the nuclear and computer sectors, there is a general feeling of lack of purpose, which is aggravated by the severity of the economic crisis.

Once the current economic crisis is overcome, the question of what to do with the science and technology sector will return. Should Brazil go back to the days of the Geisel government, with heavy investment in science and technology as part of a drive for technological self-sufficiency? Or should it organise the sector more in tune with the present reality?

The policies of the 1970s can be described by two orientations in apparent contradiction: import substitution in science, and elitism in technology. The first policy consisted of an attempt to create scientific capabilities in all areas of knowledge, mostly through graduate and research programmes scattered throughout the country and by sending several thousand students abroad every year. The notion behind this policy was that, with sustained support and protection, small research groups could become larger, intellectually weak institutions could become stronger, and the byproducts of academic research would spill over to technology and professional education, if given enough time and protection from competitive evaluation. The consequence of this policy was, at its worst, to create a constituency for public support for second class research and graduate education; and, at its best, to strengthen a few good quality research and graduate education institutions, which had difficulties translating their competence into good professional education and viable applied work.

The second policy led to an emphasis on large-scale, advanced technology projects – the space programme, computer hardware, the atomic submarine – and the neglect of the diffusion of scientific and technological competence throughout society. A rationale for this policy was the idea that Brazil was besieged by countries which would not relinquish their technologies, a blockade which could only be overcome by heavy investments and national determination. The other rationale was that high technology projects would spill over to the productive system as a whole.

Unfortunately, none of these assumptions was justified. The Brazilian

economy was highly internationalised already in the sixties and seventies, and there was little demand for the scientific and technological know-how generated by the country's new research institutions. The large technological projects spilled over to a small sector of closely associated industries, but failed to reach the economy as a whole. The computer policy ran against the broader logic and interests of the economy, and was finally abandoned. Loose criteria in the distribution of scientific grants and fellowships, and the establishment of a sizeable science and technology bureaucracy, created active interest groups with the ability to press for resources, but with few products to show in return.

The current policies for science and technology are limited to an effort to assure the flow of resources needed to keep the existing institutions going, and to finish some large-scale projects which stagnated through lack of resources. A recent independent policy paper has proposed, among other things, the following recommendations for the sector:¹⁵

- Research institutions, particularly in universities, should be required to play a very active role in the enhancement of undergraduate and technical education, not only through teaching, but also through direct involvement in the production of good quality textbooks, the development of curricula and new teaching methods and programmes of continuous education. Adequate mechanisms should be devised to make these activities more rewarding and prestigious than they have been so far.
- The current military projects should come under technical, academic and strategic evaluation with the participation of selected, high quality scientific advisers, and be either streamlined, discontinued, reduced, or converted to civilian projects.
- Support for basic science should be maintained and expanded, with special attention to its quality, according to accepted international standards (...). The government should guarantee a stable and predictable flow of resources for its main science and technology agencies for their daily routines and 'over the counter' peer reviewed research supporting activities.
- Government agencies dealing with matters requiring research work, such as health, education, environment, energy, communications and transportation, should have resources to contract research with universities and research institutions on matters of their interest. This practice should prevail over the tendency of these agencies to create their own research outfits, and their projects should be subject to joint evaluations by peer review and policy-oriented authorities.
- The channels for international cooperation between Brazil, international agencies and institutions, and the international scientific community,

should be kept open and expanded. (...) The issues of protectionism vs. market competitiveness in scientific and technological development should be dealt with in pragmatic, rather than in ideological terms. The country should not renounce its instruments of technological and industrial policy, including tax incentives, tariff protection, patent legislation, government procurement and long-term investments in technological projects, in association with the private sector. Adequate legislation for patents and intellectual property should be established with the understanding that they are necessary for the normalisation of Brazil's relations with the industrialised countries.

The aim of these recommendations is to built stronger links between research and the productive system, on the one hand, and the educational system on the other; to reduce the emphasis on high-technology, big-science projects, and replace it with the improvement of the country's productive basis; and to increase the quality of basic research, enabling the country's scientists to participate fully and tap the knowledge resources available in the world's scientific centres.

Conclusions

This overview of the knowledge sector, from basic education to science and technology, points to two central elements which seem to be at the root of Brazil's inability to overcome the knowledge barrier: the lateness of its educational efforts, and its extremely narrow base. The first attempts to organise public basic education date from the 1920s and 1930s, together with the first universities. Public secondary and higher education institutions, however, have existed since the 19th century. Secondary and higher education expanded quickly in the sixties and seventies to respond to the aspirations of the emerging middle class, in a period of intense social mobility, when the problems of basic education were still far from being solved. The next step was the expansion of graduate education and sophisticated research, while the coverage of higher education remained one of the lowest in the region.

These characteristics of Brazilian education are probably related to Brazil's recent past of slavery, which lasted until 1888, and still translate into elitist ideologies and attitudes that are very hard to overcome. The high rates of failure in basic education point to an educational system more concerned with selecting elites than with educating most of the population. The same process takes place at the secondary school level, where professional education is neglected, and the curricula are totally determined by the race for admission to the universities. Higher education institutions, in turn, are highly stratified in terms of quality, access and success rates, and there are no alternatives of short-term and vocational education for those who cannot or do not want to compete.

Most of Brazil's knowledge institutions developed through the expansion of the public sector, public subsidies, or professional monopolies granted to the educated. Now the public sector is contracting, and status privileges are being threatened, while the demand for more quantity and more relevant education increases all the time, catching the educated professions and groups in between. School teachers, students in public universities, professional associations, researchers in their laboratories, professors in public universities, all complain about low salaries, faulty equipment and lack of support for their activities, but are seldom enthusiastic about changes that could threaten their recently acquired and still uncertain privileges. School teachers resist school autonomy and systematic achievement tests; university professors are against managerial autonomy for universities, and mistrust evaluations. They defend free tuition in public universities, to the benefit of students from the higher strata, and are against public support for the private sector, the only space open for those of lower social origins. Scientists and technologists dream of pure science and high technology, but are often unwilling to renounce some of their autonomy for the benefit of explicit educational and applied goals. Politicians resist giving up the opportunities of political patronage derived from the educational budgets and their power to administer public education.

The consequence of this situation is that the changes needed to make Brazil overcome the knowledge barrier will be made, if at all, against the will and with the opposition of large sections of those more directly related to the knowledge sector - teachers, professors, researchers. This contrasts very sharply with countries that modernised their educational institutions earlier, thanks, in large part, to the reformist and modernising drives of their educated sectors. In this later age, educational reform requires other actors to enter the arena. This is precisely what seems to be happening now. As knowledge becomes a central ingredient for social and economic development, other groups, until now unconcerned with these questions, are likely to become more involved, and induce change. As with wars, and there is war now, science and education are too important to be left to scientists and educators, and there are signs that they may be starting to lose their monopolies.

Notes

1. UNESCO/CEPAL, *Educación y Conocimiento: Eje de la Transformación Productiva con Equidad* (Santiago, 1993).
2. The following section is based on Schwartzman, Simon, Eunice R. Durham and José Goldemberg, *Educação no Brasil em uma perspectiva de transformação*, paper prepared for the Inter American Dialogue project on education in Latin America, São Paulo, NUPES, 1993.
3. See Ribeiro, Sérgio Costa, 'A Pedagogia da Repentência', *Estudos*

Avançados, Vol. 5, No. 12, May-August 1991, pp. 7-21. Costa Ribeiro has pioneered the revision of the basic education statistics in Brazil and the reinterpretation of their meaning; this section is based on his work.

4. Gatti, Bernadete, *Problemas da Educação no Brasil: A exclusão das massas populacionais*, Organización de los Estados Americanos, Proyecto Multinacional de Educación Básica, Washington, July 1990, p. 79. The data on *per capita* expenditures are from Antônio Carlos da R. Xavier and Emílio S. Marques, 'Custo Direto de Funcionamento das Escolas de Primeiro Grau', Brasília, SEB/MEC, 1987 (published in Ministério da Educação, *A Educação no Brasil na Década de 80*, MEC/SAG/CPS/SIG, 1990).

5. For the history of Brazilian education, see Piletti, Nelson, *História da educação no Brasil*, 2nd. edition (São Paulo: Atica, 1991). For the initiatives of the 1930s, see Pena, Maria Luiza, *Fernando de Azevedo: educação e transformação* (São Paulo: Perspectiva, 1987); Schwartzman, Simon, Helena Bomeny and Vanda R. Costa, *Tempos de Capanema* (Rio de Janeiro: Paz e Terra, EDUSP, 1984); Maria Lúcia Garcia Pallares Schaeffer, *Anísio Teixeira: formação e primeiras realizações* (São Paulo: Faculdade de Educação, Universidade de São Paulo, Série Estudos e Documentos 128, 1988).

6. Firms can also decide to use this money to provide educational assistance to their employees and families, and this has led to all kinds of results, from interesting experiments to makeshift schools.

7. 'In March 1987, at the end of the state administration that began in 1983, only 117 CIEPs (51 in Rio de Janeiro city and 66 in the state interior) instead of the promised 500 units, had been established. Rather than attending to the 20 per cent of first degree pupils, as had been announced, the administration managed to cover only 1.8% of the state network and 4.1% of the capital-city network, that is, 37,585 pupils were studying in CIEPs out of a total of 1,262,899 public school pupils (3 per cent).' (Luis Antônio da Cunha, *Educação, Estado e Democracia no Brasil* (Cortez Editora/FLACSO/EDUFF, 1991), p. 154. The CIEPs programme was interrupted for four years and started again with the new Brizola government in 1991. More schools were built, at considerable cost, but no reliable assessment of results exists.

8. See de Mello, Guimar Namo, 'Políticas públicas de educação', *Estudos Avançados*, Vol. 5, No. 13, 1991, pp. 7-48; Schwartzman, Simon, 'A Educação básica no Brasil: a agenda modernidade', *Estudos Avançados*, Vol. 5, No. 13, 1991, pp. 49-60; de Mello, Guimar Namo, and Rose N. da Silva, 'A gestão e a autonomia da escola nas novas propostas de políticas educativas para a América Latina', *Estudos Avançados*, Vol. 5, No. 12, 1991, pp. 45-60; Fundação Herbert Levy and Fundação Bradesco, *Educação Fundamental e Competitividade Industrial: uma proposta para a ação do Governo*, mimeo, 1992; Velloso, João Paulo dos Reis and Roberto Cavalcanti de Albuquerque

(eds.), *Educação e Modernidade* (São Paulo: Nobel, 1993).

9. See Salm, Cláudio, 'Educação e Treinamento de mão de obra: o papel do SENAI na Reestruturação industrial', in dos Reis Velloso and Cavalcanti de Albuquerque (eds.), *Educação e Modernidade*, pp. 193-212.

10. The number of students graduating each year from secondary schools is similar to the entrance places in higher education, around 400,000; but there are large differences in demand for public and private higher education institutions, and among careers.

11. The following section is based on 'Brazil' in Burton R. Clark and Guy Neave, *The Encyclopedia of Higher Education*, Vol. 1 (Oxford: Pergamon Press, 1992), pp. 89-92.

12. Professors in federal universities answering the Carnegie Foundation survey questionnaire claimed to spend 10.7 hours a week in the classroom, and another 5.7 hours in individualised instruction. This figure is probably overstated, since there is little individualised instruction in undergraduate courses, where most of the teaching occurs. The figures for the São Paulo state system are 8.7 and 4.2, and for private institutions, 11.9 and 5.1.

13. Schwartzman, S., 'Brazil: Opportunity and Crisis in Higher Education', *Higher Education*, Vol. 17, No. 1, 1988, pp. 99-119.

14. One of the few rankings of Brazilian higher education career programmes is published every year by the Brazilian edition of *PlayBoy* magazine. Of 35 course programmes evaluated in 1994, the best 30 were in the state of São Paulo, 22 of which were in the Universidade de São Paulo.

15. Schwartzman, Simon, Eduardo Krieger, Fernando Galembeck, Eduardo Augusto Guimarães and Carlos Osmar Bertero, *Science and Technology in Brazil: A New Policy for a Global World* (Rio de Janeiro: Fundação Getúlio Vargas, 1993).